IN THE CLAIMS

Kindly amend the claims as follows.

1. (Currently Amended) A piezoelectric micromotor for moving a moveable element comprising:

a vibrator in the shape of a rectangular parallelepiped formed from a plurality of thin layers of piezoelectric material having first and second identical relatively large rectangular face surfaces defined by long and short edge surfaces wherein the layers are aligned one on top of the other and have their face surfaces bonded together;

electrodes on surfaces of the layers;

a contact region located on one or more edge surfaces of the layers, urged against the body; and

a least one electrical power supply that electrifies electrodes to excite vibrations in the vibrator and thereby in the contact region that impart motion to the body;

wherein at least some of the electrodes are electrifiable to excite transverse vibrations in the vibrator, which transverse vibrations are vibrations parallel to the one or more edges of the layers on which the contact region is situated and at least some of the electrodes are electrifiable to excite longitudinal vibration in the vibrator that are perpendicular to the one or more edges and the at least one power supply controls electrification to independently control excitation of longitudinal and transverse vibrations so as to selectively generate different forms of vibratory motion in the vibrator.

2. (Original) A piezoelectric micromotor according to claim 1 wherein the one or more edge surfaces are short edge surfaces of the layers.

3. (Previously Amended) A piezoelectric micromotor according to claim 1 and including a wear resistant element situated at the contact region for contact with the body.

4. (Currently Amended) A piezoelectric micromotor according to claim 1 ~~comprising electrodes on face surfaces of the layers that are electrifiable by an AC voltage provided by the~~ wherein the at least one power supply electrifies the electrodes to excite elliptical vibrations in the vibrator having ~~a controllable~~ different ~~eccentricity~~ eccentricities.

5. (Previously Cancelled)

6. (Previously Amended) A piezoelectric micromotor according to claim 1, comprising:

a single large electrode on a first face surface of each layer; and

four quadrant electrodes on the second face surface of at least one layer, wherein the quadrant electrodes are arranged in a checkerboard pattern.

7. (Previously Amended) A piezoelectric micromotor according to claim 6 wherein at least two non-contiguous face surfaces have quadrant electrodes.

8. (Previously Cancelled)

9. (Previously Cancelled)

10. (Previously Amended) A piezoelectric micromotor according to claim 6 wherein for at least one layer the at least one power supply electrifies a first pair of diagonally disposed quadrant electrodes with a first AC voltage and a second pair of quadrant electrodes along a second diagonal with a second AC voltage and wherein the first and second AC voltages are 180^{o} out of phase and have a same magnitude, so as to excite transverse vibrations in the piezoelectric vibrator.

11. (Original) A piezoelectric motor according to claim 10 wherein the at least one layer comprises a plurality of layers and wherein homologous electrodes on different layers of the plurality of layers are electrified with the same voltage.

12. (Previously Amended) A piezoelectric motor according to claim 43 wherein the at least one power source controls magnitudes of AC voltages used to excite longitudinal and transverse vibrations to selectively provide different forms and amplitudes of vibratory motion of the contact region in a plane parallel to the planes of the layers.

13. (Previously Amended) A piezoelectric motor according to claim 43 wherein the at least one power source controls phases of AC voltages used to excite longitudinal and transverse vibrations to selectively provide different forms of vibratory motion of the contact region in a plane parallel to the planes of the layers.

14. (Previously Amended) A piezoelectric motor according to claim 43 wherein the at least one power source controls frequencies of AC voltages used to excite longitudinal and

transverse vibrations to selectively provide different forms of vibratory motion of the contact region in a plane parallel to the planes of the layers.

15. (Previously Amended) A piezoelectric micromotor according to claim 6 wherein for at least one layer the at least one power supply electrifies a first pair of electrodes along a first short edge of the layer and a second pair of quadrant electrodes along a second short edge with first and second AC voltages respectively that are 180^{o} out of phase and have a same magnitude, so as to excite bending vibrations perpendicular to the planes of the layers in the piezoelectric vibrator.

16. (Original) A piezoelectric motor according to claim 15 wherein the at least one layer comprises a plurality of layers.

17. (Original) A piezoelectric motor according to claim 16 wherein homologous electrodes on layers located on a same side of a face surface inside the vibrator are electrified in phase and homologous electrodes on layers located on opposite sides of the face surface are electrified 180^{o} out of phase.

18. (Previously Amended) A piezoelectric motor according to claim 49 wherein the at least one power source controls magnitudes of AC voltages used to excite longitudinal and bending vibrations to selectively provide different forms and amplitudes of vibratory motion of the contact region in a plane perpendicular to the planes of the layers.

19. (Previously Amended) A piezoelectric motor according to claim 49 wherein the at least one power source controls phases of AC voltages used to excite longitudinal and bending vibrations to selectively provide different forms of vibratory motion of the contact region in a plane perpendicular to the planes of the layers.

20. (Previously Amended) A piezoelectric motor according to claim 49 wherein the at least one power source controls frequencies of AC voltages used to excite longitudinal and transverse vibrations to selectively provide different forms of vibratory motion of the contact region in a plane parallel to the planes of the layers.

21. (Previously Amended) A piezoelectric micromotor according to claim 6 wherein, for at least one layer, the at least one power supply electrifies a pair of quadrant electrodes that lie

along a first diagonal of the layer with an AC voltage while a pair of quadrant electrodes along a second diagonal of the layer are grounded or floating, in order to excite elliptical vibrations in the vibrator.

22. (Original) A piezoelectric micromotor according to claim 21 wherein the at least one layer comprises a plurality of layers and wherein homologous electrodes are electrified with the same AC voltage.

23. (Previously Amended) A piezoelectric motor according to claim 21 wherein the at least one power supply controls the frequency of the AC voltage to selectively control the eccentricity of the elliptical motion.

24. (Previously Amended) A piezoelectric micromotor according to claim 1 and comprising at least one relatively thin layer of non-piezoelectric material having large rectangular face surfaces defined by long and short edges and relatively narrow long and short edge surfaces.

25. (Original) A piezoelectric micromotor according to claim 24 wherein the one of the edges of the at least one non-piezoelectric layer are substantially equal in length to one of the corresponding edges of the piezoelectric layers.

26. (Original) A piezoelectric motor according to claim 25 wherein the one edge is a short edge.

27. (Previously Amended) A piezoelectric micromotor according to claim 25 wherein the other edges of the at least one non-piezoelectric layer are slightly longer than the corresponding other edges of the piezoelectric layers so that at least one edge surface of the non-piezoelectric layer protrudes from the piezoelectric layers.

28. (Original) A piezoelectric motor according to claim 27 wherein the other edge is the long edge and wherein at least one short edge surface of the non-piezoelectric layer protrudes from the piezoelectric layers.

29. (Previously Amended) A piezoelectric micromotor according to claim 27 wherein the contact region comprises a region of one of the at least one protruding edge surface.

30. (Previously Amended) A piezoelectric micromotor according to claim 25 wherein the at least one non-piezoelectric layer is formed from a metal.

31. (Currently Amended) A piezoelectric micromotor according to claim ~~1~~ 15 wherein the power supply is capable of electrifying the electrodes to cause motion in a selective~~ly~~ arbitrary direction in the plane of edge surfaces on which the contact surface is located.

32. – 42. (Withdrawn)

43. (Currently Amended) A piezoelectric micromotor according to claim 10 wherein the at least one power supply electrifies all quadrant electrodes on the second face surface of at least one but not all the layers with a same AC voltage so as to excite longitudinal vibrations in the vibrator. ~~and thereby in the contact surface wherein longitudinal vibrations are vibrations perpendicular to the edges of the layers on which the contact region is situated.~~

44. (Previously Added) A piezoelectric micromotor according to claim 10 and comprising a single large electrode on the second face surface of at least one but not all layers.

45. (Currently Amended) A piezoelectric micromotor according to claim 44 wherein the power supply electrifies a large electrode on the second face surface of at least one layer with an AC voltage to excite longitudinal vibrations in the vibrator and thereby in the contact region wherein longitudinal vibrations. ~~are vibrations perpendicular to the edges of the layers on which the contact region is situated.~~

46. (Previously Added) A piezoelectric motor according to claim 45 wherein the at least one power source controls magnitudes of AC voltages used to excite longitudinal and transverse vibrations to selectively provide different forms and amplitudes of vibratory motion of the contact region in a plane parallel to the planes of the layers.

47. (Previously Added) A piezoelectric motor according to claim 45 wherein the at least one power source controls phases of AC voltages used to excite longitudinal and transverse vibrations to selectively provide different forms of vibratory motion of the contact region in a plane parallel to the planes of the layers.

48. (Previously Added) A piezoelectric motor according to any of claims 45 wherein the at least one power source controls frequencies of AC voltages used to excite longitudinal and transverse vibrations to selectively provide different forms of vibratory motion of the contact region in a plane parallel to the planes of the layers.

49. (Currently Amended) A piezoelectric micromotor according to claim 15 wherein the at least one power supply electrifies all quadrant electrodes on the second face surface of at least one but not all the layers with a same AC voltage so as to excite longitudinal vibrations in the vibrator and thereby in the contact surface. ~~wherein longitudinal vibrations are vibrations perpendicular to the edges of the layers on which the contact region is situated.~~

50. (Previously Added) A piezoelectric micromotor according to claim 15 and comprising a single large electrode on the second face surface of at least one but not all layers.

51. (Currently Amended) A piezoelectric micromotor according to claim 50 wherein the power supply electrifies a large electrode on the second face surface of at least one layer with an AC voltage to excite longitudinal vibrations in the vibrator. ~~and thereby in the contact region wherein longitudinal vibrations are vibrations perpendicular to the edges of the layers on which the contact region is situated.~~

52. (Previously Added) A piezoelectric motor according to claim 50 wherein the at least one power source controls magnitudes of AC voltages used to excite longitudinal and transverse vibrations to selectively provide different forms and amplitudes of vibratory motion of the contact region in a plane parallel to the planes of the layers.

53. (Previously Added) A piezoelectric motor according to claim 50 wherein the at least one power source controls phases of AC voltages used to excite longitudinal and transverse vibrations to selectively provide different forms of vibratory motion of the contact region in a plane parallel to the planes of the layers.

54. (Previously Added) A piezoelectric motor according to any of claims 50 wherein the at least one power source controls frequencies of AC voltages used to excite longitudinal and transverse vibrations to selectively provide different forms of vibratory motion of the contact region in a plane parallel to the planes of the layers.

55. (New) A piezoelectric micromotor for moving a moveable element comprising:

a vibrator in the shape of a rectangular parallelepiped formed from a plurality of thin layers of piezoelectric material having first and second identical relatively large rectangular face surfaces defined by long and short edge surfaces wherein the layers are aligned one on top of the other and have their face surfaces bonded together;

a single large electrode on a first face surface of each layer;

four quadrant electrodes arranged in a checkerboard pattern on the second face surface of at least one layer

a contact region located on one or more edge surfaces of the layers, urged against the body; and

a least one electrical power supply that electrifies pairs of quadrant electrodes disposed along different diagonals with AC voltages that are 180° out of phase with each other to excite transverse vibrations parallel to the at least one or more edges and all quadrant electrodes on the second face surface of at least one but not all the layers with a same AC voltage to excite longitudinal vibrations in the vibrator and controls magnitudes of AC voltages used to excite longitudinal and transverse vibrations to selectively provide different forms and amplitudes of vibratory motion of the contact region in a plane parallel to the planes of the layers.

56. (New) A piezoelectric micromotor for moving a moveable element comprising:

a vibrator in the shape of a rectangular parallelepiped formed from a plurality of thin layers of piezoelectric material having first and second identical relatively large rectangular face surfaces defined by long and short edge surfaces wherein the layers are aligned one on top of the other and have their face surfaces bonded together;

a single large electrode on a first face surface of each layer;

four quadrant electrodes arranged in a checkerboard pattern on the second face surface of at least one layer

a contact region located on one or more edge surfaces of the layers, urged against the body; and

a least one electrical power supply that electrifies pairs of quadrant electrodes disposed along different diagonals with AC voltages that are 180° out of phase with each other to excite transverse vibrations parallel to the at least one or more edges and all quadrant electrodes on the second face surface of at least one but not all the layers with a same AC voltage to excite longitudinal vibrations in the vibrator and controls phases of AC voltages used to excite longitudinal and transverse vibrations to selectively provide different forms of vibratory motion of the contact region in a plane parallel to the planes of the layers.

57. (New) A piezoelcctric micromotor for moving a moveable element comprising:

a vibrator in the shape of a rectangular parallelepiped formed from a plurality of thin layers of piezoelectric material having first and second identical relatively large rectangular face surfaces defined by long and short edge surfaces wherein the layers are aligned one on top of the other and have their face surfaces bonded together;

a single large electrode on a first face surface of each layer;

four quadrant electrodes arranged in a checkerboard pattern on the second face surface of at least one layer

a contact region located on one or more edge surfaces of the layers, urged against the body; and

a least one electrical power supply that electrifies pairs of quadrant electrodes disposed along different diagonals with AC voltages that are 180^{o} out of phase with each other to excite transverse vibrations parallel to the at least one or more edges and all quadrant electrodes on the second face surface of at least one but not all the layers with a same AC voltage to excite longitudinal vibrations in the vibrator and controls frequencies of AC voltages used to excite longitudinal and transverse vibrations to selectively provide different forms of vibratory motion of the contact region in a plane parallel to the planes of the layers.

REMARKS

The present amendment is in response to the office action mailed on May 15, 2003 and includes a request for a two month extension in the due date for a response.

The application contains 54 claims of which claims 1- 4, 6, 7, 10-31 and 43-54 are pending and claims 32 to 42 are withdrawn. Claims 1-4, 6, 7, 10-31 and 43-54 stand rejected under 35 U.S.C. 102(a) as being anticipated by Kasuga (063) or Inio (769). Claims 1-4, 6, 7 10-31 and 43-54 also stand rejected under 35 U.S.C. 103(a) over Diefenbach, O'Brien or Zumeris (140) in view of Siagoh (Jap J. Appl. Phys Vol.34).

In the present amendment claims 1, 4, 31, 43, 45, 49 and 51 are amended and new claims 55-57 are added.

Claim 1 is amended to include the limitations that "at least some of the electrodes are electrifiable to excite longitudinal vibration in the vibrator that are perpendicular to the one or more edges and the at least one power supply controls electrification to independently control excitation of longitudinal and transverse vibrations so as to selectively generate different forms of vibratory motion in the vibrator".

Support for the amendment is found in the numerous examples described in the specification and shown in the figures of different vibratory motions that a micromotor in accordance with the invention may be executed. See for example, the discussion on page 16 line 14 through page 17 line 7 and Figs. 2B and 2D. In particular, the above referenced discussion notes that "By exciting and controlling longitudinal and transverse vibrations independently of each other, friction nub 90 can be controlled to execute many different forms of motion and these motions can be finely controlled" (page 16 lines 14-16) and that a coupling region can even be controlled to execute a figure eight (page 17 lines 1-2).

Claim 4 is amended to remove the limitation of "electrodes ..electrifiable to excite elliptical vibrations", which limitation is not required in claim 4, as amended claim 1 comprises such electrodes. Claim 4 is also amended to change "controllable eccentricity " to "different eccentricities".

Claim 31 is amended to change its dependence on claim 1 to dependence on claim 15 and to correct the word "selectively" to "selective". Claim 15 provides for excitation of bending vibrations, which enable the micromotor "to cause motion in a selective arbitrary direction in the plane of edge surfaces on which the contact surface is located". Claim 31 was originally dependent on claim 15 through multiple claim dependency.

Claims 43, 45, 49 and 51 are amended to remove repetition of the definition of longitudinal vibrations recited in amended claim 1.

Currently added claims 55, 56 and 57 are independent claims that recite the limitations of original claims 12, 13 and 14 respectively and each also recites the limitations of original claims 1, 6, 10 and previously added claim 43.

None of the prior art cited by the Examiner teaches or in any way implies a multilayer micromotor having a power supply that electrifies electrodes on the micromotor layers and controls electrification to "independently control excitation of longitudinal and transverse vibrations *so as to selectively generate different forms of vibratory motion* in the vibrator."

Furthermore, each of patents 063 and 769 teaches away from controlling electrification to selectively generate different forms of vibratory motion. For example, to increase a particular one of "the output of the flexing vibration" (*i.e.* transverse vibration) or "the output of the stretching vibration" (*i.e.* longitudinal vibration) independent of the other, the 063 patent does not teach controlling electrification of the flexing or stretching piezoelectric members. Instead it teaches adding more of the members responsible for the particular one of the vibrations (*i.e.* the flexing or longitudinal vibration, see column 3 line 60 to column 4 line 22). The 769 patent similarly teaches "Further, by changing a ratio of numbers of sheets of the first piezoelectric oscillators and the second piezoelectric oscillators, a ratio of magnitudes of the elongation and contraction vibration and the bending vibration can be changed" (column 3 lines 49 - 52, also see for example the text in column 11 lines 8-13). Saigoh also teaches away from controlling electrification to selectively generate different forms of vibratory motion and notes (page 2760, second column first paragraph) "The number of B2 layers was about twice the number of the L1 layers. This is because B2 amplitude is increased to avoid the influence of moving surface roughness."

As a result, claim 1 is neither anticipated by any of the references cited by the Examiner nor made obvious by any combination of the references. Applicants submit that claim 1 is therefore patentable and that claims directly or indirectly dependent on claim 1, are patentable through dependence on claim 1 or as a consequence of patentable material that they contain. New added independent claims 55-57 are patentable for the same reasons that claim 1 is patentable.

In view of the above remarks applicants submit that all the claims in the amended claim set are patentable. An action on the merits is respectfully awaited.

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